

Impact of sea ice initialisation on sea ice and atmosphere prediction skill on seasonal timescales

Virginie Guemas, Matthieu Chevallier, Michel Déqué,
Francisco Doblas-Reyes

Introduction

- Potential predictability of the Arctic sea ice cover – memory thought to be held by the sea ice thickness
- Potential impact of the Arctic sea ice cover on the overlying atmosphere and on the mid-latitude climate
- Several seasonal forecast systems do not include a sea ice model yet or do not initialize it from observations



What is the impact of sea ice initialization from observations in dynamical forecast systems on :

- the sea ice prediction skill ?**
- the near surface atmosphere prediction skill ?**

Experimental setup

- CNRM-CM and EC-Earth2.3
- Seasonal forecasts initialized every 1st November and every 1st May from 1979 to 2012 – 34 forecasts
- 7 month long
- Initialized from ERA-interim for the atmosphere + in-home sea ice reconstructions + ORAS4 for the ocean
- 5/12 members using initial perturbations applied to the atmosphere, ocean and sea ice components for EC-Earth2.3, only the atmosphere and ocean for CNRM-CM
- Sensitivity experiment : climatological sea ice initialization

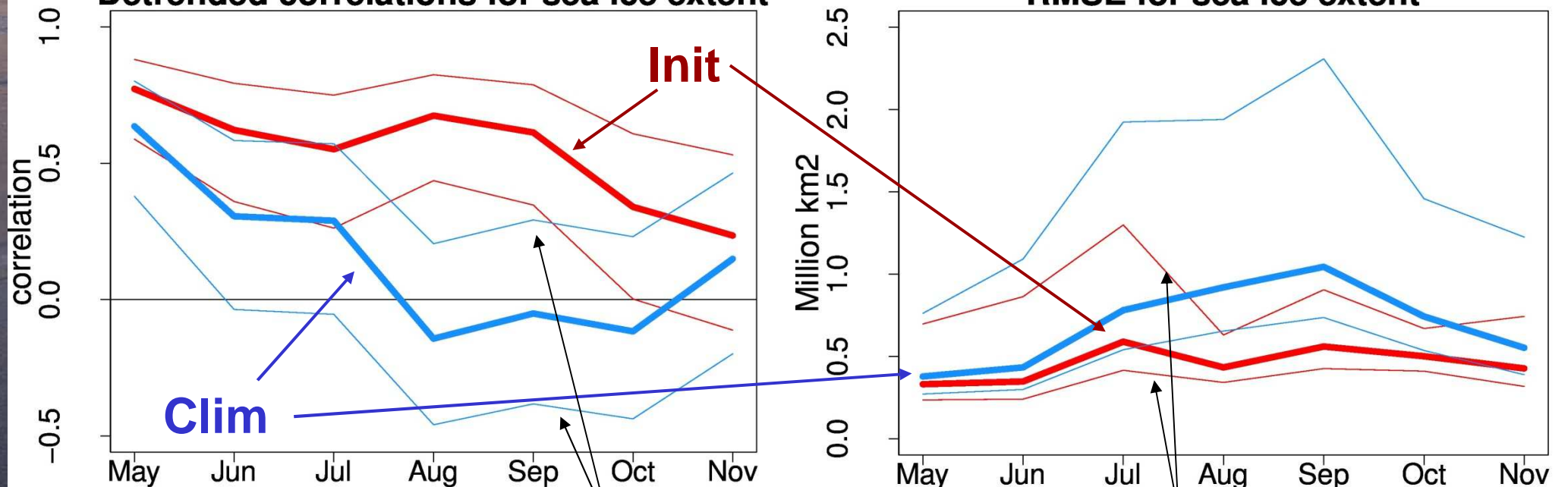
Init

Clim

Arctic predictions from May with CNRM-CM

Detrended correlations for sea ice extent

RMSE for sea ice extent



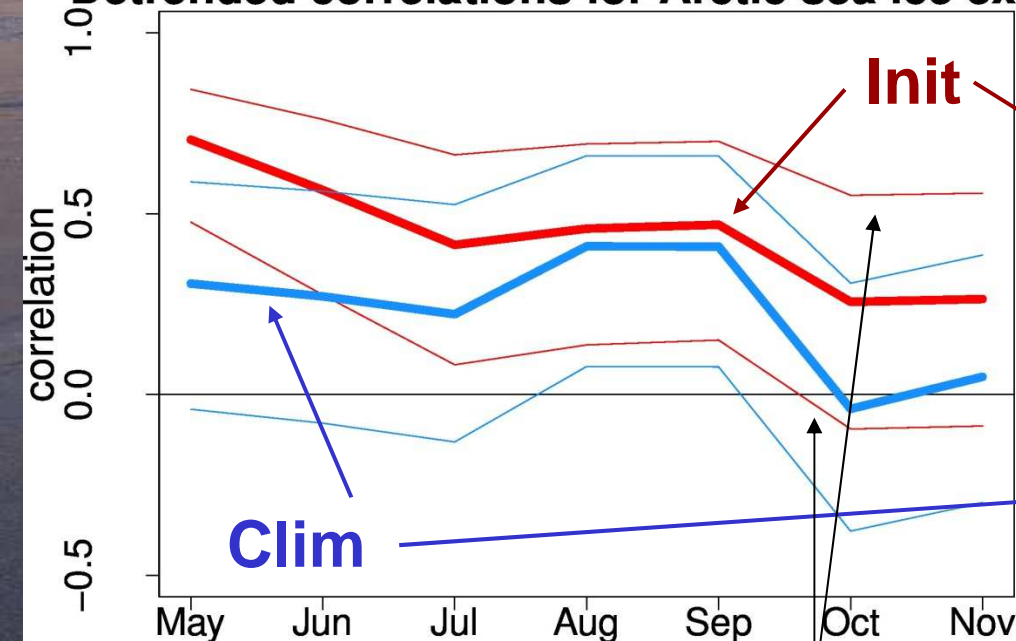
Reference dataset: NSIDC

95% confidence interval

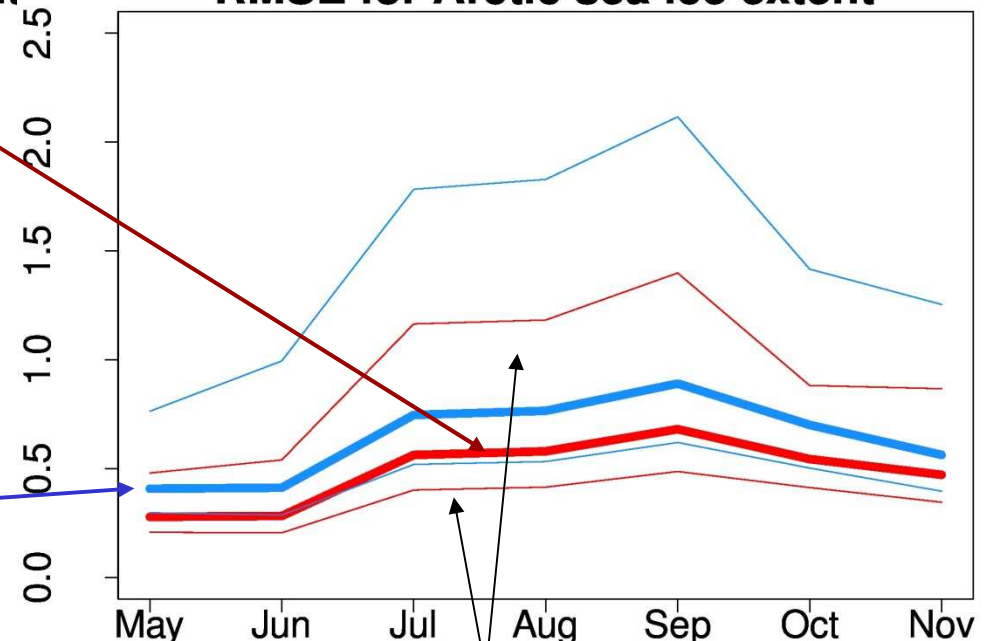
**Sea ice skill increase in the Arctic with sea ice
initialisation, which is not only due to the long-term trend**

Arctic predictions from May with EC-Earth

Detrended correlations for Arctic sea ice extent



RMSE for Arctic sea ice extent



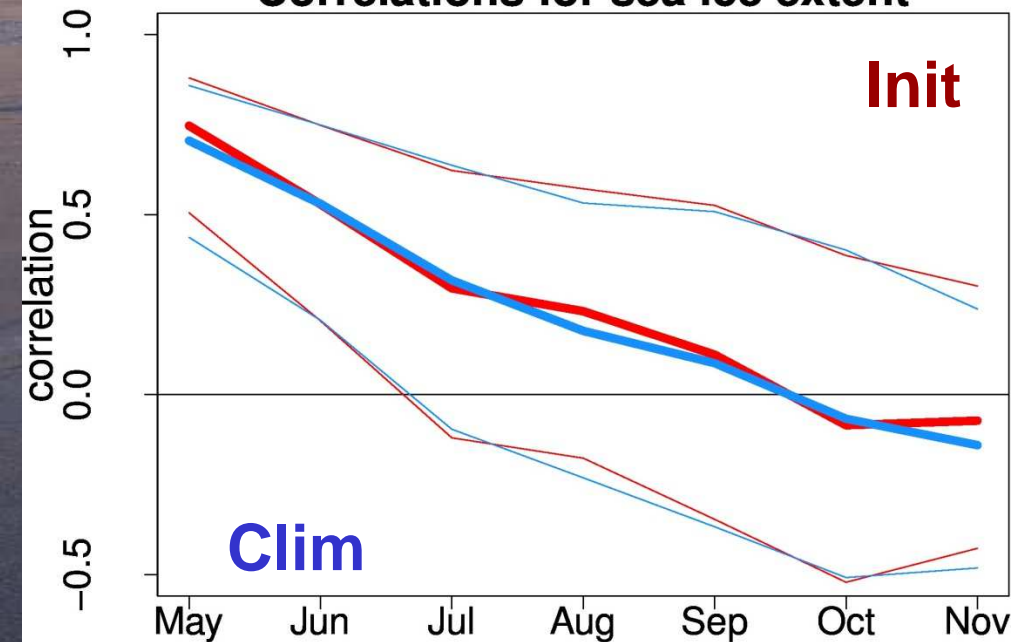
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95% confidence interval

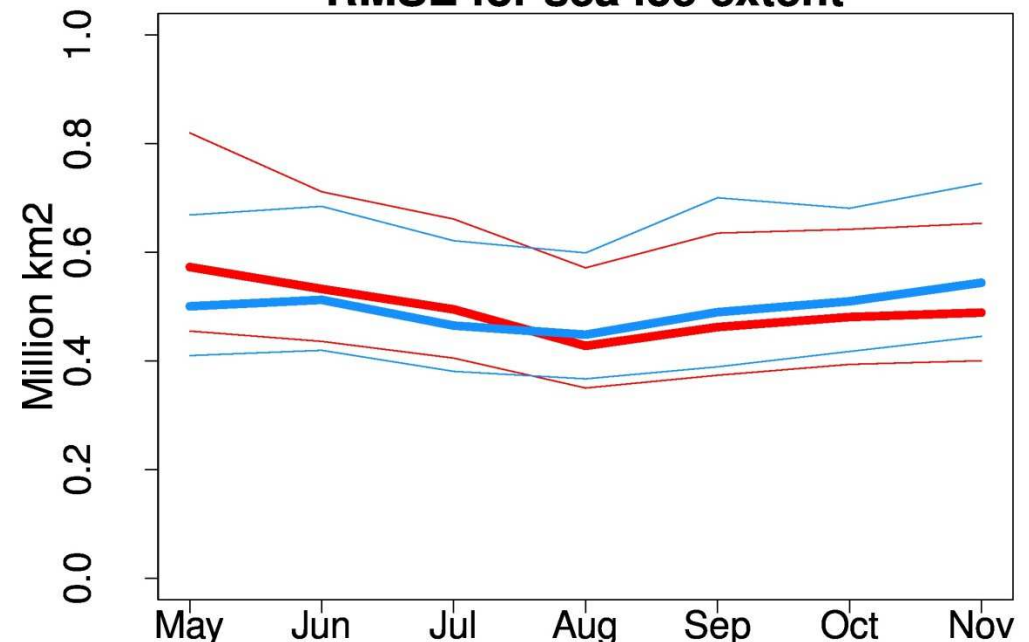
Robust conclusions against the model used

Antarctic predictions from May with CNRM-CM

Correlations for sea ice extent



RMSE for sea ice extent



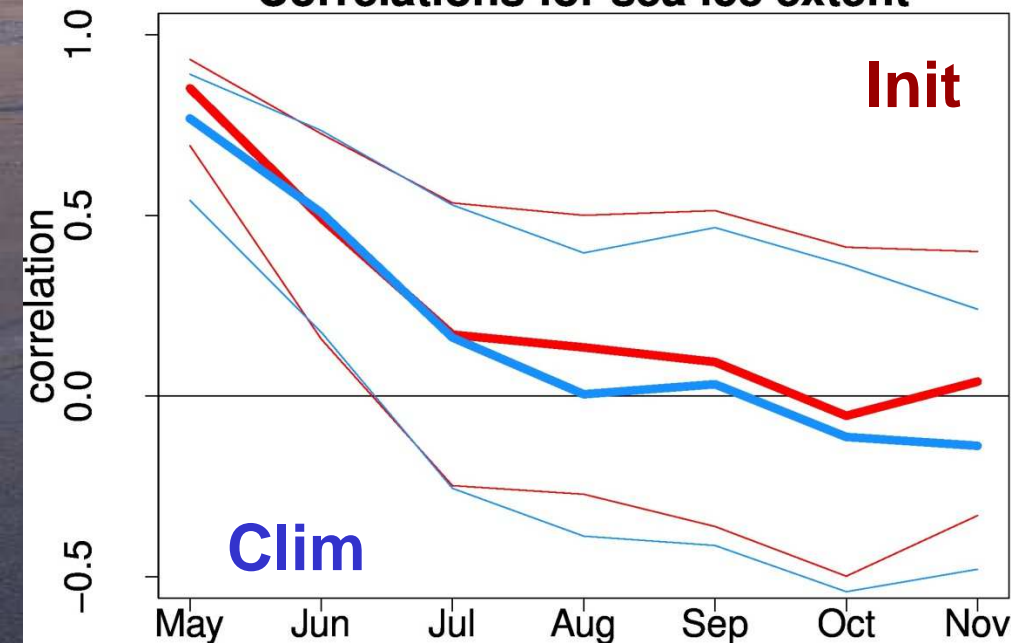
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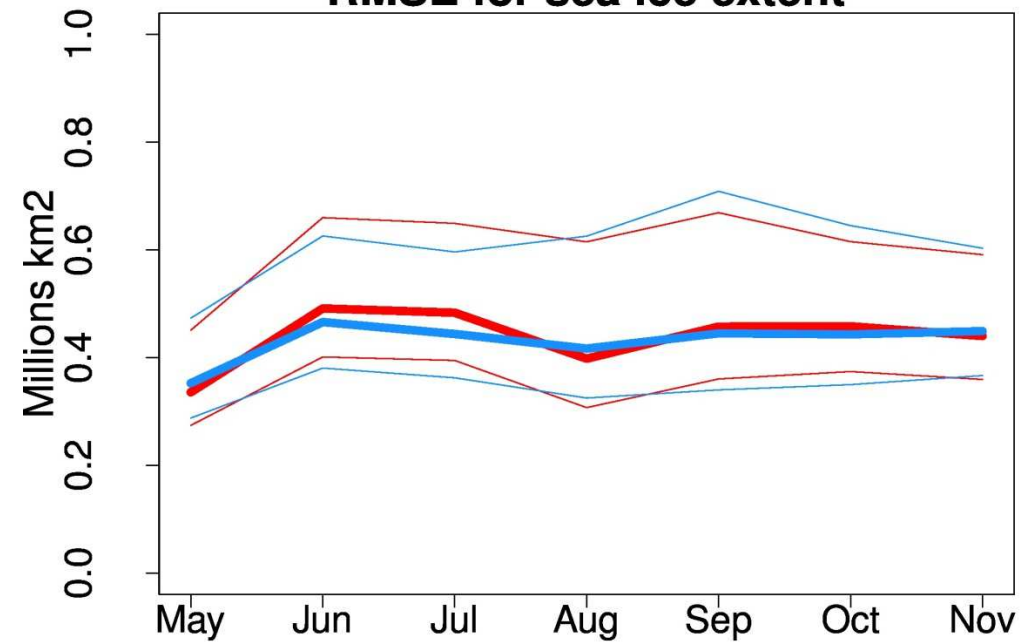
Negligible impact of sea ice initialization in May on the sea ice skill in the Antarctic, skill coming from the ocean?

Antarctic predictions from May with EC-Earth

Correlations for sea ice extent



RMSE for sea ice extent

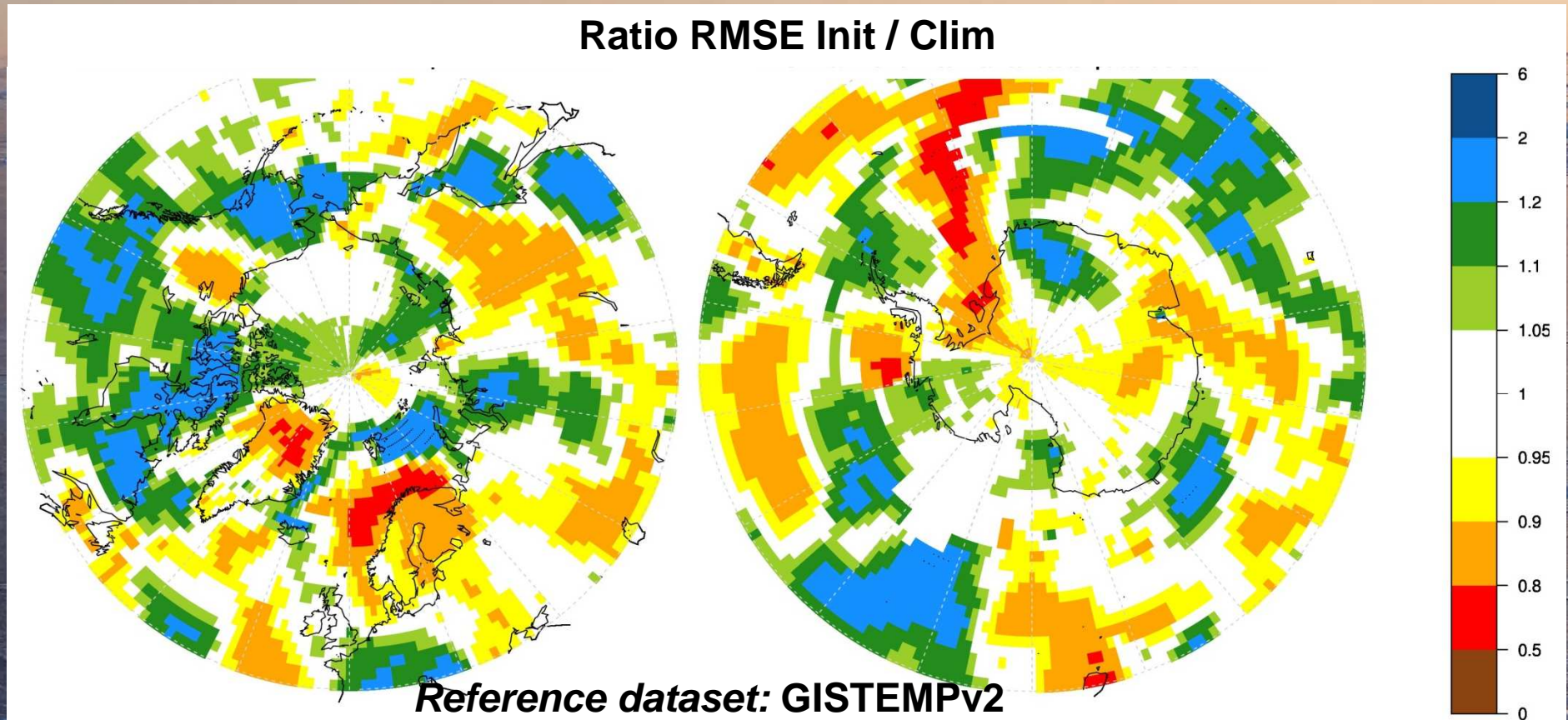


Reference dataset: NSIDC



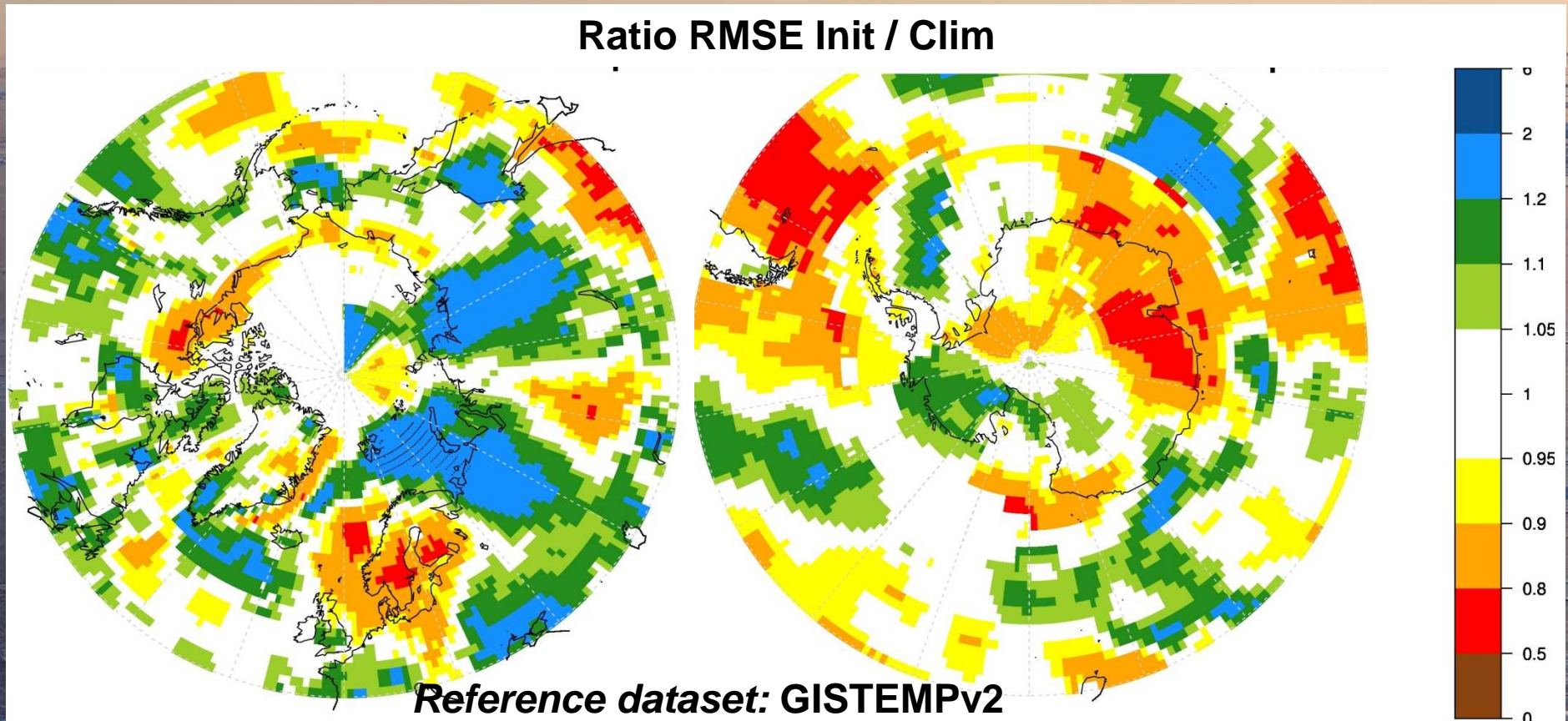
Robust conclusions against the model used

JJA near surface temperature with CNRM-CM



Nothing significant except decrease in skill over the
Barents Sea, more areas of decrease in skill

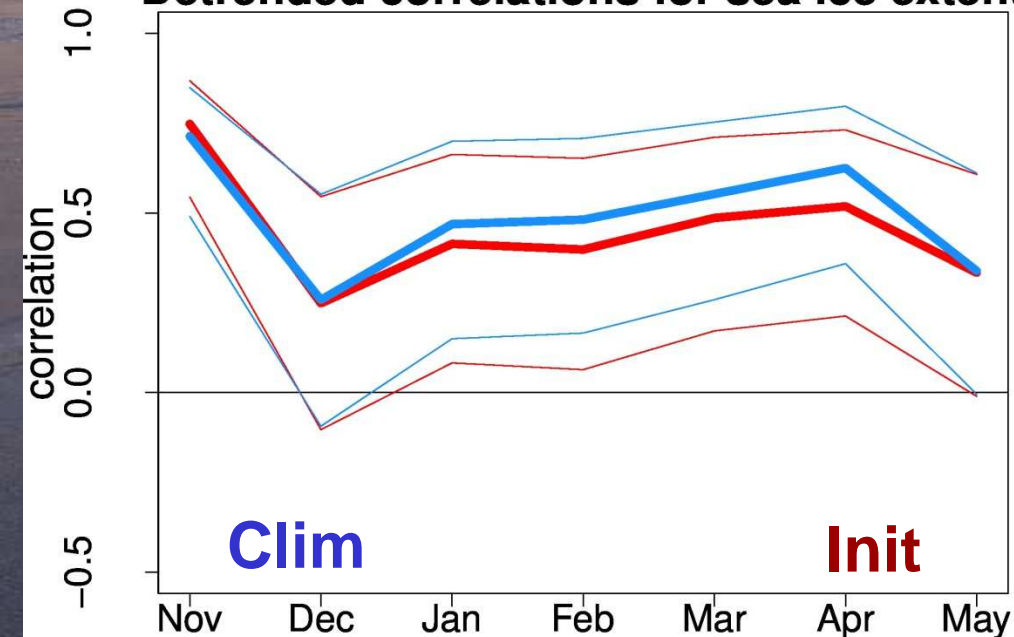
JJA near surface temperature with EC-Earth



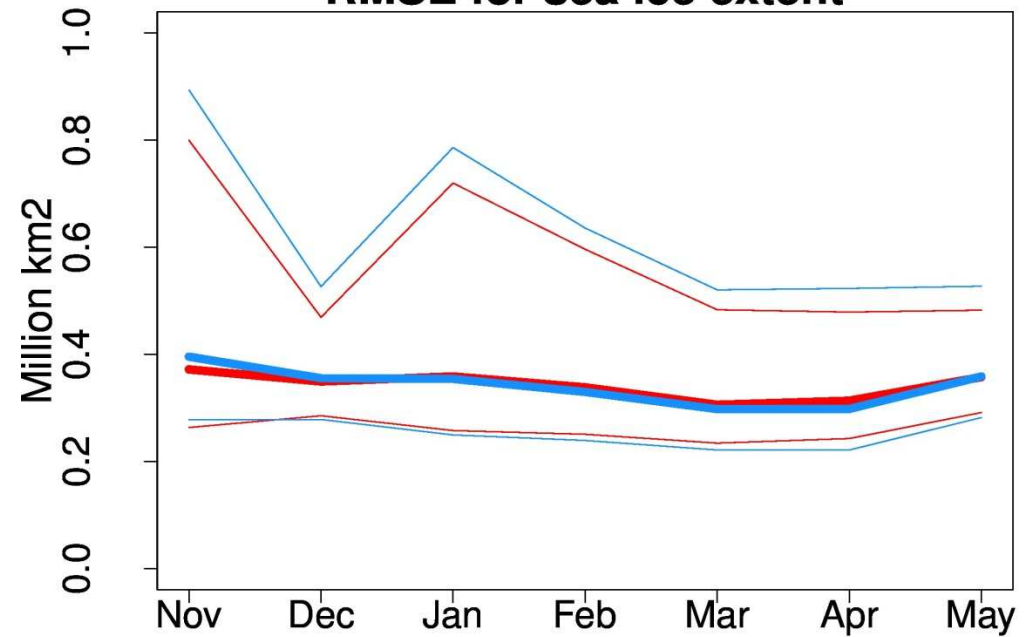
Robust decrease in skill over the Barents Sea & increase over the Greenland Sea

Arctic predictions from November with CNRM-CM

Detrended correlations for sea ice extent



RMSE for sea ice extent



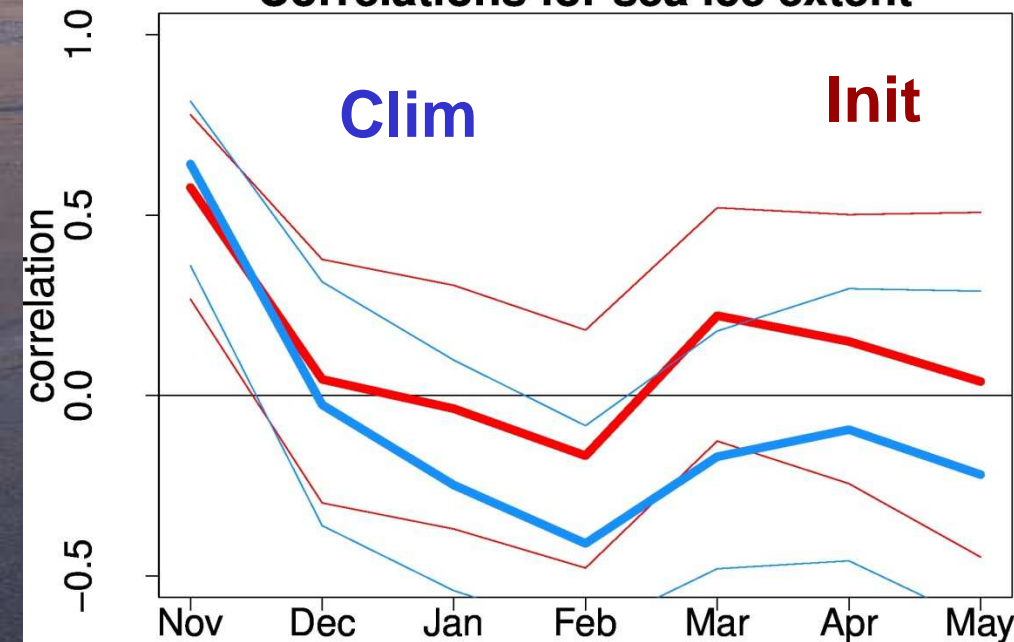
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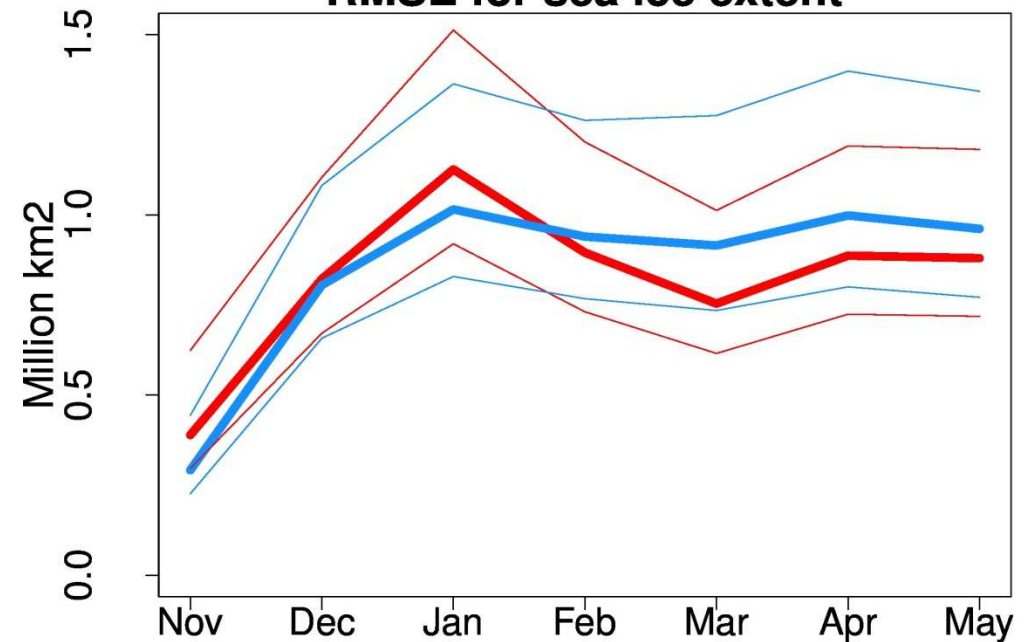
No clear impact of sea ice initialization in November on the sea ice skill, skill coming from the ocean?

Antarctic predictions from November

Correlations for sea ice extent



RMSE for sea ice extent

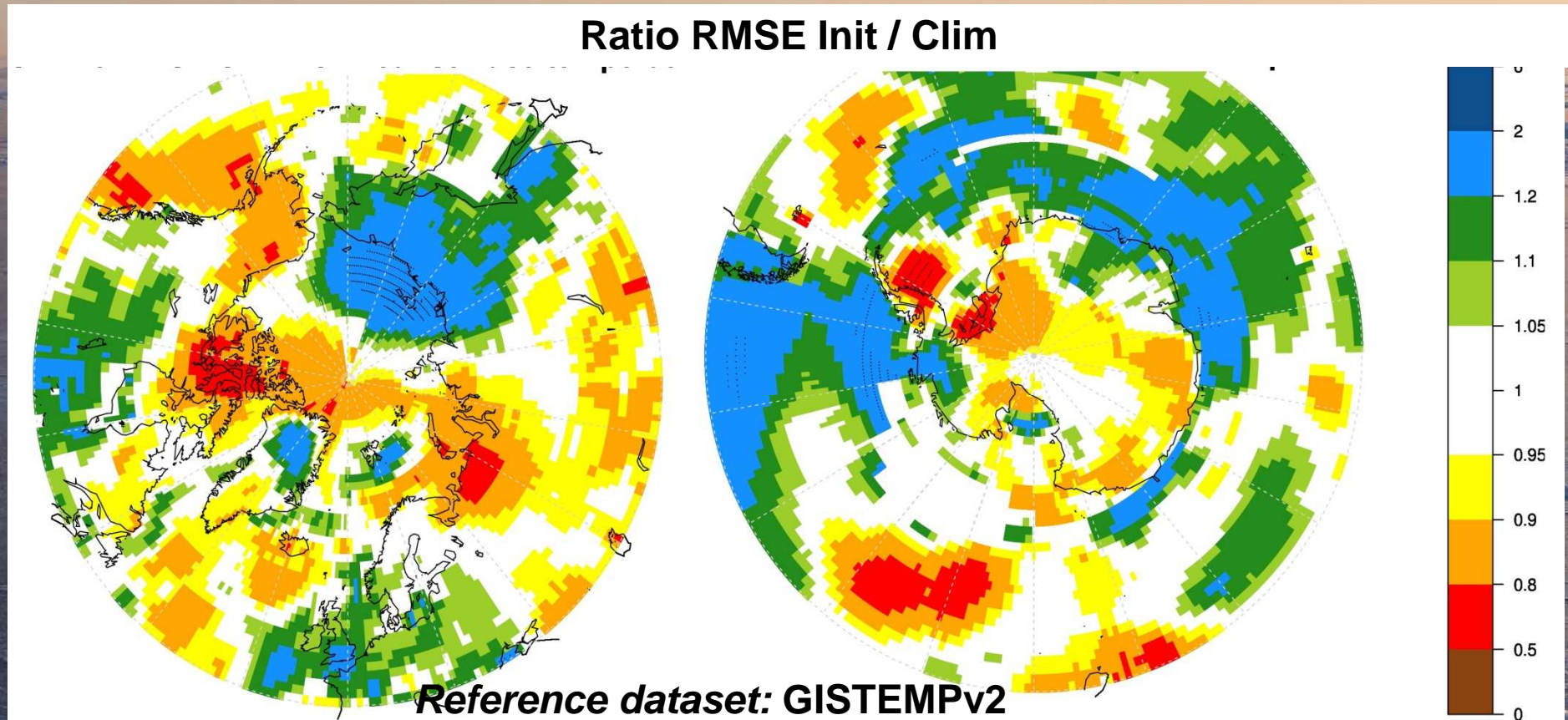


Reference dataset: NSIDC



No clear impact of sea ice initialization in November on the sea ice skill

DJF near surface temperature with EC-Earth



Decrease in skill over the East Siberian Sea & increase over the Wedell Sea

Conclusions

- 2 dynamical forecast systems – 34 forecast start dates with 5 to 12 members -> robust assessment of the prediction skill
- Robust added-value of sea ice initialization in May on the sea ice prediction skill in the Arctic during the following summer and autumn – sea ice thickness ?
- Skill in predicting the Arctic sea ice from November onward and the Antarctic sea ice from May but not due to sea ice initialization – ocean initialization ?
- Negligible impact of sea ice initialisation on the atmospheric skill except for a significant decrease in skill in the Barents Sea in JJA and East Siberian Sea in DJF and an increase in skill in the Greenland Sea in JJA and the Wedell Sea in DJF